PORTABLE ELECTRONIC APPARATUS HAVING A PLURALITY OF INFRARED PORTS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention generally relates to portable electronic apparatuses including a portable calculator, a mobile information processing terminal and a notebook-size computer, and in particular to a portable electronic apparatus having an infrared communication function.

2. Description of the Related Art

Recently, the infrared communication function has been provided in an increasingly number of portable electronic apparatuses. Using infrared components which are relatively inexpensive, wireless data communications can easily be implemented between sender and receiver or between each of these and a common target over a relatively small area.

As shown in FIG. 1, respective portable electronic apparatuses **1** and **2** are provided with infrared (IR) emitting/receiving elements **3** and **4** built therein. In cases where data is transmitted from the portable electronic apparatus **1** to the other apparatus **2** and vice versa, the respective IR emitting/receiving elements **3** and **4** of the apparatuses **1** and **2** are directed toward each other so as to make a line of sight connection between them.

However, such a conventional electronic apparatus is not easy to use in some situations. For instance, in cases where two users want to make a data communication through the IR transmission in a conference room where each user must usually be seated, the apparatuses **1** and **2** cannot transmit data to each other without changing in direction so as to direct the respective IR emitting/receiving elements **3** and **4** toward each other.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a portable electronic apparatus which is easy to use infrared transmissions.

Another object of the present invention is to provide a portable electronic apparatus which enables infrared communications with another apparatus without the inconvenience of directing both the apparatuses toward each other.

According to the present invention, the housing of a portable electronic apparatus is provided with a plurality of infrared element connectors on the surfaces thereof. A detachable infrared emitting/receiving element is electrically connected to one selected from the infrared element connectors so as to provide the best infrared connection. In other words, from the infrared element connectors in different directions, a connector is selected which is directed toward the opposite apparatus. Therefore, the infrared transmission is made with the reduced inconvenience of changing the direction of the apparatuses.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a diagram showing the infrared transmission between conventional portable electronic apparatuses;

FIG. **2** is a perspective view showing a portable electronic apparatus according to an embodiment of the present invention;

FIG. **3** is a partial sectional view of a connector portion of the portable electronic apparatus according to the embodiment;

FIG. **4** is a block diagram showing a schematic internal circuit of the portable electronic apparatus according to the embodiment; and

FIG. **5** is a diagram showing the infrared transmission between the portable electronic apparatuses according to the embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. **2**, a portable electronic apparatus **10** according to an embodiment of the present invention is composed of a housing **101** containing integrated circuits necessary for implementing desired functions including the infrared communication function. The housing **101** has a display **102** such as a liquid crystal display (LCD) on the top surface thereof and IR element connectors or ports **103–105** on the respective sides thereof. A detachable IR emitting/receiving element **106** is inserted into a desired one of the IR element connectors **103–105** to make an electrical connection to the transmitter/receiver of the apparatus **10**. The detachable IR emitting/receiving element **106** has an IR light-emitting diode (LED) and a photodiode (not shown) therein.

Referring to FIG. **3**, each of the IR element connectors **103–105** is a connector with two pairs of pins **107** for transmitting and receiving, respectively. The IR element connectors **103–105** are of the same construction such that a recess is formed on the side surface of the housing **101** with the pins **107** placed therein. The detachable IR emitting/receiving element **106** has a connector with two pairs of sockets **108** into which the respective pins **107** plug as indicated by an arrow in FIG. **3**. The two pairs of sockets **108** are electrically connected to the IR light-emitting diode and the photodiode, respectively. Since the IR element connectors **103–105** are of the same construction, the detachable IR emitting/receiving element **106** can be attached to a desired one of the IR element connectors **103–105**. In other words, according to this embodiment, the infrared transmission can be made in three directions by inserting the detachable IR emitting/receiving element **106** into one of the IR element connectors **103–105** without changing the direction of the apparatus **10**. Needless to say, in cases where the four sides of the housing **101** are provided with four IR element connectors of the same construction, respectively, four-direction IR transmission may be achieved.

Referring to FIG. **4**, the apparatus **10** includes the following circuits necessary for IR communication. A transmitter/receiver **201** is electrically connected in common to the respective IR element connectors **103–105**, each of which is capable of sending transmitting signals to the detachable IR emitting/receiving element **106** and receiving signals from the same. When receiving a signal from one of the IR element connectors **103–105**, the transmitter/receiver **201** sends the received signal to a modulator/demodulator (MODEM) **202** where the received signal is demodulated. The demodulated signal is processed under control of a controller **203** and then transferred to a user interface **204** including a graphical user interface displayed on the display **102**. When transferring a signal to the detachable IR emitting/receiving element **106**, the controller **203** controls the user interface **204** such that the user can inputs instructions and transmitting data through the user interface **204**. According to the instructions, the controller **203** processes the data, which is then modulated by the modem **202**. The modulated signal is transferred to all the IR element con-